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AUTHOR Barten, Sybil S.
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ABSTRACT

Data on four infants between the ages of 12 and 20 months were collected to answer two questions about children's communication behavior. (1) Is there a correspondence between communicative intentions expressed in gestures and vocal utterances? If both spring from common organismic tendencies, it should be possible to discern an "indicating" vocalization corresponding to an indicating gesture, and a "demand" vocalization corresponding to a demand gesture. (2) What phonetic features of vocalization typically accompany indicating/demand gestures? All sessions with the children were videotaped so that children's gestures and vocal utterances could be analyzed. The analyses indicated that pointing gestures were almost exclusively accompanied by vocal indicating expressions. By contrast, two-thirds of the reaching gestures were accompanied by demand vocalizations. About two-thirds of the undifferentiated indicating gestures were accompanied by indicating vocal expressions. The vocalizations accompanying pointing gestures were phonetically more differentiated than those accompanying either of the other gestural modes. These results indicated in a most preliminary way that different communicative intentions are expressed in more than a single modality, and that at least some contrasts among such intentions may be understood developmentally. (RL)

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THE EXPRESSION OF COMMUNICATIVE INTENTIONS IN GESTURE AND VOCALIZATION

Sybil S. Barten

S.U.N.Y., College at Purchase

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The study which I shall present today concerns the relationship between gestural and vocal communicative intentions. Following Werner and Kaplan (1963), Dore, Franklin, Miller, and Ramer (1976) and Bruner (1974, 1975), we may distinguish between two aspects of any message, verbal or nonverbal: its intention and its referent. The intention of a message involves the orientation to the object or context, for example indicating, requesting, demanding, calling. Such pragmatic communicative intentions (see Bates, 1976) are to be distinguished from the referent, namely the notion, object, context, or event that the child has in mind in communicating. Different communicative intentions involve different relationships toward both the referent and the addressee to whom the message is directed. In demanding an object, for example, the child wants to come closer to the object in order to consume it, play with it, etc., and tries to obtain help from the "other" in obtaining the object. On the other hand, in the indicating mode, the child's relation to the object is one of contemplating or noting the object, and the child invites the addressee to share in joint contemplation of the referent or asks the other to name the object.

At more advanced levels of communication, intention and referent can be "carried" by different aspects of the message in that intention tends to be conveyed by intonation contour, stress, and other suprasegmental features (as well as by accompanying gesture), while the referent is conveyed by the word. Such a separation presupposes a stable and fixed referential system. For example, a single word, "milk" may be said so as to express

a demand for, a question about, or a declaration of the presence of the milk. Prior to the emergence of a set of such stable referents, however, one cannot clearly differentiate between those aspects of the message which carry the intention and those which convey the referent, reflecting the greater fustion of intention and referent in the consciousness of the young child. In the case of prelinguistic vocalization, prosodic features such as intonation and stress as well as inherent phonetic patterns globally express intention as well as referent.

In support of this view, a number of investigators report that different phonetic patterns are used by prelinguistic infants in their expressions of different intentions. For example, Anne Carter (1979) notes that alveolar [lae] and dental forms [dɘ][dae] are used with pointing gestures in the expression of the indicating mode; [da] is mentioned by the Sterns (cited in Werner and Kaplan, 1963) as an indicator; Dore et al. also mention the use of dental forms in indicating expressions. On the other hand, an instrumental orientation, inferred in part from accompanying reaching gestures, was observed by Carter in her child's [mm], [ma], [may], and [mɘ]; Halliday (1979) states that Nigel used [na] as a generalized demand; Lewis (1936) observed that when his son was between 14 and 16 months, he would say eh-eh-eh whenever desired objects were beyond his reach. Dore et al. (1976) also note that one of the children whom they observed consistently uttered [m] on different occasions of appeal; another child uttered [ʌʌʌ] whenever requesting food, and Dore et al. suggest that a phonetically consistent form of requesting is evidenced.

The question of the origins of different phonetic forms embodying different intentions is problematic. It seems intuitively obvious that different bodily and organismic states might express different intentions, and no one has seriously wondered why pointing is the gesture used to indicate while reaching is the motor expression of the demand intention. Here the form-function relationship seems obvious. Similarly, it does not seem necessary to explain why a more intense, high pitched vocal pattern should be associated with reaching, though the reason for a rising or a rise-fall intonation in questioning still requires explanation it seems to me. But why should different phonetic patterns express different intentions? Some authors argue that occurrence of dentals in deictic sound patterns is the result of the outwardly directed vectorial property of these sounds (see Carter, 1979; Werner and Kaplan, 1963, pp. 82-83). Other phonetic patterns similarly are said to express different vectorial-organismic tendencies. For example, the use of nasals in expressions of distaste or dislike could arise from refusal to eat, and the use of mm intuitively fits in with the use of distress and call intentions.

As a developmental psychologist, trained in the Werner and Kaplan tradition, I am very sympathetic with such dynamic and organismic interpretation of early communication, one that sees both bodily movement and vocal utterance as the expression of the whole organism. In this view, vocalizations must be seen as a process, from the viewpoint of the one who produces the sound. There is another organismic variable that has been been overlooked in the attempt to understand the prelinguistic

utterances of the child, namely the child's level of motor-affective arousal. The contrast between an object-incorporative wish or demand and an indicating intention is not simply a contrast between different intentions, but one involving different levels of excitation. It can be assumed that a child who wants an object is more highly aroused, frustrated by not attaining the object, than a child who indicates the presence or location of an object or event, who singles it out for contemplation. Further, it is well known that demand and indicating gestures appear at different ages, with pointing invariably emerging later than reaching. One might then hypothesize that indicating vocalizations might manifest a higher level of phonetic differentiation than demand vocalizations.

This developmental assumption would account for some of the differences between reaching and pointing. Only one finger is outstretched in pointing, whereas the whole hand is extended in reaching. Pointing is more assymetrical than reaching, both within the hand and in terms of hand preference. We have obtained preliminary evidence that while children tend to point with the right hand, such laterality is not evident for reaching where either hand may be used.

If this developmental assumption applies to vocalization, we should be able to discern differences in the level of differentiation of vocalizations as a function of communicative intention. For example, indicating expressions might be more internally differentiated, and to possess more sharply defin[illegible]ontours than expressions of demand. Demand vocalizations should show greater homogenity among

successive units than indicating expressions. A higher level of arousal might produce less distinct segmentation of units. Thus, more intense demanding would lead to a blurring of the sound pattern as distinct vocables are reduced to a continuous straining sound, a wail or a shriek.

The findings to be presented here derive from a longitudinal study of four infants between the ages of 12 and 20 months, conducted by Ruth Segal and myself at the College at Purchase of the SUNY. The study was conducted in a quasi-naturalistic laboratory setting and all sessions were videotaped. Not only were gestures and vocal utterances of the child recorded and analyzed, but the mother's responses to gestures were coded as well. I will not report here on the findings pertaining to developmental trends nor give evidence obtained for infant-maternal concordance, but rather will focus on the relationships between gesture and vocalization. Specifically, two questions are addressed: (1) Is there a correspondence between communicative intentions expressed in the two modalities? If both spring from common organismic tendencies, it should be possible to discern an "indicating" vocalization that corresponds to an indicating gesture, a demand vocalization together with a demand gesture. (2) What phonetic features of vocalization typically accompany the two kinds of gestures.

In order to address the first question, we coded the gestures and the vocalizations which accompanied them. We classified all object-oriented gestures into three broad categories: Pointing, Undifferentiated Indicating, and Reaching. Pointing was typically with arm outstretched or held near the body, index finger

outstretched, other fingers tightly curled. In a few instances, the point was aimed at the ceiling or behind the back, that is, was not oriented in the same direction as the child's gaze. Undifferentiated indicating lacked the dynamic vectorial quality of pointing--the arm was outstretched but the fingers were lax or curled into a loose, open fist. This category also included gestures rapidly alternating between pointing and reaching. Reaching involved holding the arm and hand straight out from the body, with the tense, outstretched hand in a palm-down orientation, and spaces between all the fingers.

The children's vocalizations were classified under the categories of Indicating Expressions, and Demands.[1] Indicating Expressions included both comments and questions. Comments usually had a flat intonational pattern, sometimes with a slight falling terminal contour. Questions had a rising or a rise-fall intonation, often with stress on the second syllable, e.g. da-$\wedge$'. Demands were characterized by a more tense, insistent quality, frequently with an increase in pitch or loudness. Call sounds were included within this category (e.g. "Mommy"). We did not rigorously specify criteria for classifying the vocalizations, basing our global rating on overal features such as intonation, stress pattern, and duration. Ruth Segal made the ratings from the original videotapes. Since it could be argued that knowledge of the concomitant gesture might bias

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[1] 26% of the gestures were made silently, without vocal accompaniment. 26% of points, 17.5% of undifferentiated gestures, and 30% of reaches were silent. For purposes of this presentation, these will not be considered.

interpretation of the vocalization, I served as a second judge on one half of the vocalizations which had been re-recorded onto audiotape.[1] We obtained remarkably high interrater reliability: 77% of all vocalizations were identically classified; combining comments and questions (and thus disregarding disagreements between these sub-categories) our agreement rose to 86.3% in the classification of indicating expressions and demands.

Table 1 presents the findings pertaining to the relation between gestures and vocalizations. As shown in this table, pointing gestures were almost exclusively accompanied by vocal indicating expressions. By contrast, two-thirds of the reaching gestures were accompanied by demand vocalizations. Also, about two-thirds of the undifferentiated indicating gestures are accompanied by indicating vocal expressions. These findings lend strong support to the notion that both gesture and vocalization express underlying organismic communicative intentions. When a child is oriented toward designating objects for joint inspection or identification, he or she typically points to the object and makes kinds of vocalizations that differ from the gestures and typical vocal utterances made while communicating desire for an object or action. Interestingly, more than half of the undifferentiated indicating expressions accompany pointing gestures. This may, of course, be only a reflection of the somewhat lower reliability of our ratings of vocalizations for this category of gestures: many of the

[1] Every other vocalization of each type (Comments, Questions, Demands) was selected and these were re-recorded in the sequence in which they had been uttered. Only these vocalizations were used in the second analysis which follows below.

vocalizations accompanying undifferentiated indicatings gestures tend to be rapid and faint. Another possible explanation is that these more imprecise indicating gestures are the means by which children designate or refer to objects when they are younger, before the clear emergence of pointing. This is supported in our data by the finding that these imprecise indicating gestures begin to decrease in frequency around the age of 18 months when the proportion of pointing gestures begins to rise sharply.

This first analysis demonstrated a correlation (though not a perfect one) between gesture and vocalization, suggesting a non-arbitrary relationship between these two modes. However, it did not reveal the nature of the vocalizations which typically accompany different gestures. In the second analysis, now to be reported, we sought to determine whether there are phonetic differences among vocalizations associated with the various kinds of gestures. As mentioned earlier, we speculated that the object-indicating orientation might involve a lower level of arousal and therefore a higher level of phonetic differentiation than a demand orientation. In order to test this idea, the vocalizations were analyzed in terms of the following dimensions: (1) Degree of internal differentiation within units; (2) Degree of heterogeneity among phonetic units.

Degree of internal phonetic differentiation. Largely on intuitive grounds, we classified the sounds made by the children on a 5-point scale range from most to least differentiated.

5. Dentals. e.g. dɛ ; dʌ ; ədə; da-da-da.

4. Bilabials. e.g. ba-ba; bul-u-du-bal; bɔ; mo; mʌ .

3. Short glottalized vowels, e.g. e, ʌ, ɛ , ɑ·i

2. Velars, palatals, nasals, and semi-vowels, e.g. gwa; nen; wi; awʌ .

1. Sustained vowels and re-duplicated vowels, e.g. e-e-e; eeee.

Table 2 presents the frequencies and percentages of these phonetic types for each category of gesture. Most remarkable is the finding that more than half of the pointing gestures are accompanied by dentals, the category of highest differentiation, and that no pointing gestures are accompanied by reduplicated or continuous vocalic chains. By contrast, both undifferentiated indicating gestur - and reaching are accompanied by a high proportion of the least differentiated vocalizations. In order to obtain a rough overall measure of differentiation, I calculated the Mean Index of Differentiation (MID) for each gestural mode. (The footnote to Table 2 explains how this index was arrived at.) As can be seen in Table 2, the MID for pointing is much higher (4.2) than for either undifferentiated indicating (2.5) or reaching (2.8). These findings strongly suggest that vocalizations accompanying pointing are phonetically more differentiated than those which accompany either of the other gestural modes. The results are, of course, entirely dependent

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Table 2

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upon the validity of the differentiation index, and should be replicated before a definitive conclusion can be drawn.

Degree of heterogenity among units. This analysis was concerned with differentiation among successive vocables. If more than a single vocable was uttered, the vocalization was scored homogeneous if the units were identical, for example, ba-ba; it was scored heterogeneous if successive vocables were different, for example, we-i; ɘ-dɛ; a-gwa. Changes in pitch and intensity were not considered. Table 3 presents the results of this analysis.

Table 3

When reduplicated vowels are excluded, the majority of these polysyllabic utterances were heterogeneous, perhaps an indication of their greater maturity. When reduplicated vowels are included, the contrast between pointing and the other gesture categories is again evident: only one-third of the vocalizations which accompany undifferentiated indicating and reaching are heterogeneous, while 70% of the utterances made while pointing are heterogeneous.

The present study has shown in a most preliminary way that different communicative intentions are expressed in more than a single modality, and that at least some contrasts among such intentions may be understood developmentally. This organismic approach suggests that other "channels" of communication, such as facial expression and body movement, would also express these communicative intentions. If one were to pursue this developmental analysis further, it would be interesting to study the emergence of distinctions within communicative intentions. For example, within the demand orientation, the early distinction between

commands and requests may involve a difference in level of arousal and therefore may be expressed in vocalizations (as well as gestures) at different levels of differentiation. Finally, it is interesting that the indicating mode typically elicits object naming in mothers. One may speculate that the low or moderate level of arousal associated with indicating is the optimal one for processing linguistic information from another person.

Table 1

Total Frequency and Percentage of Types of Vocalization

For Each Gestural Mode

	Gesture					
	Pointing		Undifferentiated Indicating		Reaching	
Vocalization	freq.	%	freq.	%	freq.	%
Indicating Expressions	83	92.2	35	67.3	31	39.7
Demands	7	7.8	17	32.7	47	60.3
Total	90	100.0	52	100.0	48	100.0

Table 2

Total Frequencies and Percentages of Phonetic Types for Each Category of Gesture

Differentiation Level	Phonetic Type	Gesture: Pointing freq.	%	Undifferentiated Indicating freq.	%	Reaching freq.	%
5	Dental	24	51.1	4	13.3	8	20.0
4	Bilabial	10	21.3	8	26.6	6	15.0
3	Glotallized Vowel	8	17.0	2	6.7	8	20.0
2	Velars, Nasal, Semi-vowel	5	10.6	2	6.7	5	12.5
1	Reduplicated Vowel	0	0	14	46.7	13	32.5
	Total	47	100.0	30	100.0	40	100.0
	MID*	4.2		2.5		2.8	

*MID = Mean Index of Differentiation. MID is obtained by multiplying frequency of each phonetic type by its differentiation level, e.g. for Pointing, 24X5, 10X4...The sume of these weighted products is then divided by the total frequency of vocalization for that gestural category.

Table 3

Homogeneity (Hom) and Heterogeneity (Het) Among Successive Vocables Accompanying Each Gestures Mode

	Gesture					
	Pointing		Undifferentiated Indicating		Reaching	
Vocalization	Hom	Het	Hom	Het	Hom	Het
Reduplicated and sustained vowels	0	0	14	0	13	0
All other polysyllables	7	17	2	8	3	10
Total	7	17	16	8	16	10
% Het		70.8		33.3		38.5

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